AGITATION PROTECTION FOR WASTE STORAGE PONDS

DESIGN GUIDE

PURPOSE

This design guide provides recommendations to consider when designing lined earthen waste storage ponds in order to accommodate agitation activities. These ponds may include a liner of compacted clay, geosynthetic or concrete. The process of agitating these ponds to facilitate removal of waste can cause damage to some liners, so measures must be taken to protect the integrity of the liner during agitation activities.

This guide is intended as a supplement to formal waste storage pond design guidance and applicable Conservation Practice Standards. For further guidance on the design of waste storage ponds, refer to Conservation Practice Standard (313), Waste Storage Facility.

POND DIMENSIONS

Shape. Waste storage ponds are predominantly rectangular in shape but can be circular or trapezoidal. Circular waste storage ponds pose a challenge to some agitation equipment due to the difficulty in establishing adequate circulation unless tangential access ramps are provided.

Top Width. The width of the waste storage pond can have an impact on how effectively it can be serviced by agitation equipment. If the equipment is not able to reach the center of the waste storage pond, windrows of solids may accumulate near the center of the pond where agitation is not able to effectively suspend solids in the stored manure.

For rectangular waste storage systems, long and narrow ponds are the most accessible to agitation equipment. As a general rule, ponds with a maximum top width of 150 feet allow for full agitation across the full width of the bottom of the pond by most commonly used agitation equipment. The top width can be increased to a maximum of 200 feet in second stage cells or in other impoundments where the stored liquid has a thinner consistency.

Depth. The ideal pond depth for agitation is 10 feet. Shallow ponds can not be efficiently agitated and it is difficult for agitation equipment to reach down far enough in a deep pond to agitate the full volume of the liquid. On very deep ponds, equipment may be backed down the inside slope of the pond to attempt to reach deeper into the stored liquid, which poses a risk for equipment sliding into the liquid.

Providing adequate depth can also help to protect earthen lined waste storage ponds from scour by allowing agitation equipment to be suspended above the bottom of the pond rather than being placed directly on the floor. This prevents excessive erosive force from being directed at the liner, and helps to prevent scour at the edges of concrete agitation pads.

SLOPES

The most efficient inside slope for waste storage ponds is 3:1. This slope is steep enough so that solids do not have a tendency to build up on the inside slopes of the pond, but is flat enough so that there is not a significant danger of equipment sliding down the slope and into the stored liquid.

On very long ponds, erosion may occur at the waterline on the inside slopes due to wave action which forms across long uninterrupted expanses of open water. This problem can be alleviated by installing a separator dike or a floating barrier across the pond to break up wave action on long reaches.

BERMS

It is difficult for agitation equipment to maneuver and set up on waste storage ponds with narrow top berms and steep inside or outside slopes. The angles formed between the tractor and towed agitator or pump can be severe. The ideal solution to alleviate this problem is to provide a 20 to 30 foot level top width. If it is not feasible to provide a berm of this size, flattening the outside slope of the pond can also help to improve access for agitation equipment.

LINERS

Concrete. Lining a waste storage pond with concrete is the most effective method of protection against scour. Where a concrete liner is not provided, other methods of scour protection must be provided at pump out and agitation points.

Geosynthetics. It is easier to agitate solids into suspension in waste storage ponds with geosynthetic liners than in those with compacted clay liners. The geosynthetic also helps to prevent scour damage to the bottom of the pond, but should not be relied upon as the sole method of protection against scour.

Be aware that wheeled agitators may be backed down the inside slope of the pond and across the surface of the geosynthetic liner if an inadequate number of agitation ramps are provided. The consequences of damage by equipment travelling across the top of the liner must be considered during the design of waste storage ponds with geosynthetic liners.

CONCRETE AGITATION PADS

Spacing. The optimum spacing for concrete agitation pads is 100 feet. This is the interval at which a typical waste storage pond needs to be agitated. Gate openings, posts, or other methods should be used to mark the location of agitation pads.

Placement. In rectangular waste storage ponds, agitation pads should be placed at the corners and should be flat against the bottom of the pond. They should be square to the bottom toe of the inside slope and oriented so that flow is directed down the straight side of the pond where it hits the opposite slope and turns. This helps to establish circulation in the pond.

The concrete should be extended all the way to the top of the pond to help the equipment operator to locate the pad below the water surface and to prevent scour along the top edge of the concrete ramp. Concrete should be of an adequate thickness and reinforced to prevent slabs from breaking up and posing a threat of damage to agitation equipment.

OTHER SYSTEM DESIGN CONSIDERATIONS

Manure Consistency. Manure with higher solids contents buffers the agitation jet and helps to protect the pond liner from damage. Manure with a lower moisture content will also maintain solids in suspension during agitation.

Solids Separation. The use of a separator or cellular pond system is an effective way to remove solids from the manure prior to it entering the pond. This makes pump out of the pond easier and reduces the volume of solids that must be removed.

Foreign Materials. Riprap or gravel should never be used in a waste storage pond because of the risk of damage to agitation equipment and pumps if rocks are drawn in to the equipment.

Sand causes accelerated wear to agitation and pumping equipment, and some contractors may charge a premium to service a facility where sand will be encountered. The use of sand lanes is effective in reducing the volume of sand in the impounded waste.

A method used to separate sand from liquid in the manure is to design a pond with a bottom which is flat only partway along its length and which slopes to a depth of 2 to 3 feet lower at the end opposite from where the manure enters. Solids are allowed to settle out in the upper end of the pond, and liquids drain to the deeper end where they are pumped out. A vertical wall can be incorporated so that a loader in the pond can dump the sand without driving up and down the ramp for each bucket.

Drainage. Most agitation pumps do not operate efficiently with a head of less than 18 inches. When a pond has a flat bottom, this means that the pond can not be completely drained and storage capacity is lost as a result. Providing a 3 foot deep pump out sump at the bottom of the cleanout ramp would allow for the pond to be fully pumped down.

Fences. Safety fences placed along the edges of the berm at the top of the pond hinder equipment using the berm to access the pond for agitation or pump out. Safety fences should ideally be placed 50 to 60 feet from the edge of the top berm.